CLAIMS

1. A signal encoding apparatus configured to quantize an input signal, to encode the input signal quantized, and then to output the input signal encoded as an output signal, the signal encoding apparatus comprising:

a quantizer configured to quantize the input signal of a predetermined block based on a plurality of quantization methods;

a dequantizer configured to obtain a plurality of decoded signals by respectively dequantizing a plurality of input signals which are quantized by the quantizer;

an error signal calculator configured to calculate a plurality of error signals of the predetermined block , each of which indicates a difference between each of the plurality of decoded signals and the input signal;

a weight calculator configured to calculate a weight related to degree concerning whether or not quantization noise corresponding to an error signal of a short block which is shorter block than the predetermined block is virtually imperceptible for a user for each of short blocks included in the predetermined block;

a quantization method selector configured, when a plurality of first weighted error signals , each of which indicates a signal obtained by assigning a weight, corresponding to each short block included in the predetermined block, to an error signal of the short block , are generated, to compare the plurality of first weighted error signals with one another, and to select a given quantization method from among the plurality of quantization methods based on a result of the comparison;

and

an outputting unit configured, when the input signal of the predetermined block is quantized based on the given quantization method and then the input signal quantized is encoded, to output the input signal encoded as an output signal.

2. The signal encoding apparatus according to claim 1,

wherein the weight calculator calculates a weight related to degree concerning whether or not quantization noise corresponding to an error signal of each of subblocks into which the predetermined block is divided is virtually imperceptible for the user, for each subblock included in the predetermined block, and

wherein, when a plurality of first weighted error signals ,each of which indicates a signal obtained by assigning a weight, corresponding to each subblock included in the predetermined block, to an error signal of the subblock, are generated, the quantization method selector compares the plurality of first weighted error signals with one another, and selects a given quantization method from among the plurality of the quantization methods based on a result of the comparison.

3. The signal encoding apparatus according to claim 1, further comprising:

an electric power calculator configured to calculate electric power values of the plurality of first weighted error signals respectively, and

wherein the quantization method selector compares the electric power values of the plurality of first weighted error signals with one another, and selects a given quantization method

from among the plurality of the quantization methods based on a result of the comparison.

4.   The signal encoding apparatus according to claim 1, further comprising:

an instructing unit configured, when a predetermined quantization method is selected by the quantization method selector, to instruct the quantizer not to perform quantization based on any quantization method other than the predetermined quantization method.

5.   The signal encoding apparatus according to claim 1, further comprising:

a quantization method generator congigured to generate the plurality of quantization methods based on an amount of information of encoding terms necessary for expressing the output signal to be outputted from the output unit.

6.   The signal encoding apparatus according to claim 2,
        wherein the weight calculator comprises:
        a prediction analyzer configured to calculate linear prediction parameters by performing a linear prediction analysis of the input signal for each subblock included in the predetermined block; and
        a weight generator configured to generate, for each subblock, a weight related to degree concerning whether or not quantization noise corresponding to an error signal of the subblock is virtually imperceptible for the user, based on the linear prediction parameters thus calculated.

7. The signal encoding apparatus according to claim 2,

wherein, instead of performing the calculating process for each of the subblocks included in the predetermined block, the weight calculator comprises:

a prediction analyzer configured to calculate linear prediction parameters by performing a linear prediction analysis of the input signal for each of the subblocks;

a weighting prediction parameter calculator configured to calaculate , based on the linear prediction parameters calculated for each of the subblocks, an average of the linear prediction parameters for each subblock, and to calculate weighting linear prediction parameters corresponding to the predetermined block, based on the average of the linear prediction parameters calculated for each subblock; and

a weight generator configured to generate a weight related to degree concerning whether or not quantization noise corresponding to an error signal of the predetermined block is virtually imperceptible for the user, based on the weighting linear prediction parameters corresponding to the predetermined block, and

wherein, instead of performing the processing for selecting the given quantization method in the case that the plurality of first weighted error signals are generated, the quantization method selector, when a plurality of second weighted error signals ,each of which indicates a signal obtained by assigning the weight generated by the weight generator, to an error signal of the predetermined block, are generated, compares the plurality of second weighted error signals with one another, and selects a given quantization method from among the plurality of quantization methods based on a result of the comparison.

8. The signal encoding apparatus according to claim 2,

wherein the weighting calculator comprises:

a transformer configured to subject the input signal to linear transformation into a transformed signal for each of the subblocks;

a weight generator configured to generate, for each of the subblocks, a weight related to degree concerning whether or not quantization noise corresponding to an error signal of the subblock is virtually imperceptible for the user, based on the transformed signal of each subblock; and

an inverse transformer configured to perform an inverse linear transformation of each weight thus generated.

9. The signal encoding apparatus according to claim 2,

wherein, instead of performing the calculating process for each of the subblocks included in the predetermined block, the weight calculator comprises:

a transformer configured to subject the input signal to linear transformation into a transformed signal for each of the subblocks;

a transformation average value calculator configured to calculate , based on transformed signal values which are values of each transformed signal subjected to the linear transformation, transformation average values corresponding to the predetermined block ,each indicating an average of the transformed signal values;

a weight generator configured to generate a weight related to degree concerning whether or not quantization noise corresponding to an error signal of the predetermined block is

virtually imperceptible for the user, based on the transformation average values corresponding to the predetermined block; and

an inverse transformer configured to perform inverse linear transformation of the weight generated by the weight generator, and

wherein, instead of performing the processing for selecting the given quantization method in the case that the plurality of first weighted error signals are generated, the quantization method selector, when a plurality of second weighted error signals ,each of which indicates a signal obtained by assigning the weight inversely transformed by the inverse transformer, to an error signal of the predetermined block, are generated, compares the plurality of second weighted error signals with one another, and selects a given quantization method from among the plurality of quantization methods based on a result of the comparison.

10. The signal encoding apparatus according to claim 2,
wherein the weight calculator comprises:

a signal electric power value calculator configured to calculate a signal electric power value indicating an electric power value of the input signal for each of the subblocks; and

a weight generator configured to generate, for each of the subblocks, a weight related to degree concerning whether or not quantization noise corresponding to an error signal of the subblock is virtually imperceptible for the user, based on the signal electric power value corresponding to each subblock.

11. The signal encoding apparatus according to claim 2,
wherein, instead of performing the calculating process

for each of the subblocks included in the predetermined block, the weight calculator comprises:

a signal electric power value calculator configured to calculate a signal electric power value indicating an electric power value of the input signal for each of the subblocks;

a function calculator configured to calculate , based on respective signal electric power values thus calculated, an electric power function corresponding to the predetermined block indicating distribution of the respective signal electric power values; and

a weight generator configured to generate a weight related to degree concerning whether or not quantization noise corresponding to an error signal of the predetermined block is virtually imperceptible for the user , based on the electric power function calculated, and

wherein, instead of performing the processing for selecting the given quantization method in the case that the plurality of first weighted error signals are generated, the quantization method selector, when a plurality of second weighted error signals , each of which indicates a signal obtained by assigning the weight generated by the weight generator, to an error signal of the predetermined block, are generated, compares the plurality of second weighted error signals with one another, and selects a given quantization method from among the plurality of quantization methods based on a result of the comparison.

12. A signal encoding method for quantizing an input signal, for encoding the input signal quantized, and then for outputting the input signal encoded as an output signal, the signal encoding method comprising:

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a quantization step of quantizing the input signal of a predetermined block based on a plurality of quantization methods;

a step of obtaining a plurality of decoded signals by respectively dequantizing a plurality of quantized signals;

a step of calculating a plurality of error signals of the predetermined block, each of which indicates a difference between each of the plurality of decoded signals and the input signal;

a weight calculation step of calculating, a weight related to degree concerning whether or not quantization noise corresponding to an error signal of a short block which is shorter block than the predetermined block is virtually imperceptible for a user for each of short blocks included in the predetermined block;

a first selection step, when a plurality of first weighted error signals, each of which indicates a signal obtained by assigning a weight, corresponding to each short block included in the predetermined block, to an error signal of the short block, are generated, to compare the plurality of first weighted error signals with one another, and to select a given quantization method from among the plurality of quantization methods based on a result of the comparison; and

a step, when the input signal of the predetermined block is quantized based on the given quantization method and then the input signal quantized is encoded, of outputting the input signal encoded as an output signal.

13. The signal encoding method according to claim 12,

wherein the weight calculation step comprises a step of calculating, a weight related to degree concerning whether or not quantization noise corresponding to an error signal of each

of subblocks into which the predetermined block is divided is virtually imperceptible for the user, for each subblock included in the predetermined block, and

wherein, when a plurality of first weighted error signals ,each of which indicates a signal obtained by assigning a weight, corresponding to each subblock included in the predetermined block, to an error signal of the subblock, are generated, the first selection step comprises a step of comparing the plurality of first weighted error signals with one another, and selects a given quantization method from among the plurality of the quantization methods based on a result of the comparison.

14. The signal encoding method according to claim 12, further comprising:

a step of calculating electric power values of the plurality of first weighted error signals respectively, and

wherein the first selection step comprises a step of comparing the electric power values of the plurality of first weighted error signals with one another, and of selecting a given quantization method from among the plurality of the quantization methods based on a result of the comparison.

15. The signal encoding method according to claim 12, further comprising:

a step of instructing a unit configured to perform the quantization step so as not to perform quantization based on any quantization method other than a predetermined quantization method, when the predetermined quantization method is selected in the first selection step.

16. The signal encoding method according to claim 12, further comprising:

a step of generating the plurality of quantization methods based on an amount of information of encoding terms necessary for expressing the output signal to be outputted.

17. The signal encoding method according to claim 13,

wherein the weight calculation step comprises:

a step of calculating linear prediction parameters by performing a linear prediction analysis of the input signal for each of the subblocks in the predetermined block; and

a step of generating, for each subblock, a weight related to degree concerning whether or not quantization noise corresponding to an error signal of the subblock is virtually imperceptible for the user, based on the linear prediction parameters thus calculated.

18. The signal encoding method according to claim 13, comprising, instead of the weight calculation step:

a step of calculating linear prediction parameters by performing a linear prediction analysis of the input signal for each of the subblocks;

. a step of calculating ,based on the linear prediction parameters calculated for each of the subblocks, an average of the linear prediction parameters for each subblock;

a step of calculating weighting linear prediction parameters corresponding to the predetermined block, based on the average of the linear prediction parameters calculated for each subblock;
and

a generation step of generating a weight related to degree concerning whether or not quantization noise corresponding to an error signal of the predetermined block is virtually imperceptible for the user, based on the weighting linear prediction parameters corresponding to the predetermined block, and

comprising, instead of the first selection step,

a step, when a plurality of second weighted error signals ,each of which indicates a signal obtained by assigning the weight generated in the generation step , to an error signal of the predetermined block, are generated,of comparing the plurality of second weighted error signals with one another, and of selecting the given quantization method from among the plurality of quantization methods based on a result of the comparison.

19. The signal encoding method according to claim 13,

wherein the weight calculation step comprises:

a step of subjecting the input signal to linear transformation into a transformed signal for each of the subblock;

a step of generating, for each of the subblocks, a weight related to degree concerning whether or not quantization noise corresponding to an error signal of the subblock is virtually imperceptible for the user, based on the transformed signal of each subblock; and

a step of performing an inverse linear transformation of each weight thus generated.

20. The signal encoding method according to claim 13, comprising,

instead of the weighting calculation step:

a step of subjecting the input signal to linear transformation into a transformed signal for each of the subblocks;

a step of calculating ,based on transformed signal values which are values of each transformed signal subjected to the linear transformation, transformation average values corresponding to the predetermined block ,each indicating an average of the transformed signal values;

a step of generating a weight related to degree concerning whether or not quantization noise corresponding to an error signal of the predetermined block is virtually imperceptible for the user, based on the transformation average values corresponding to the predetermined block; and

an inverse transformation step of performing inverse linear transformation of the generated weight, and

further comprising, instead of the first selection step:

a step, when a plurality of second weighted error signals ,each of which indicates a signal obtained by assigning the weight inversely transformed by the inverse transformer, to an error signal of the predetermined block, are generated, of comparing the plurality of second weighted error signals with one another, and of selecting a given quantization method from among the plurality of quantization methods based on a result of the comparison.

21. The signal encoding method according to claim 13, wherein the weight calculation step comprises:

a step of calculating a signal electric power value indicating an electric power value of the input signal for each

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of the subblocks; and

a step of generating, for each of the subblocks, a weight related to degree concerning whether or not quantization noise corresponding to an error signal of the subblock is virtually imperceptible for the user, based on the signal electric power value corresponding to each subblock.

22. The signal encoding method according to claim 13, comprising, instead of the weighting calculation step:

a step of calculating a signal electric power value indicating an electric power value of the input signal for each of the subblocks;

a step of calculating ,based on respective signal electric power values thus calculated, an electric power function corresponding to the predetermined block indicating distribution of the respective signal electric power values; and

a generation step of generating a weight related to degree concerning whether or not quantization noise corresponding to an error signal of the predetermined block is virtually imperceptible for the user, based on the calculated electric power function, and

further comprising, instead of the first selection step:

a step, when a plurality of second weighted error signals ,each of which indicates a signal obtained by assigning the weight generated in the generation step, to an error signal of the predetermined block, are generated, of comparing the plurality of second weighted error signals with one another, and of selecting a given quantization method from among the plurality of quantization methods based on a result of the

comparison.

23. A program for performing quantization of an input signal, for encoding the quantized input signal, and then for outputting the encoded input signal as an output signal, the program causing a computer to execute processing comprising:

a quantization step of quantizing the input signal of a predetermined block based on a plurality of quantization methods;

a step of obtaining a plurality of decoded signals by respectively dequantizing a plurality of quantized signals;

a step of calculating a plurality of error signals of the predetermined block, each of which indicates a difference between each of the plurality of decoded signals and the input signal;

a weight calculation step of calculating, a weight related to degree concerning whether or not quantization noise corresponding to an error signal of a short block which is shorter block than the predetermined block is virtually imperceptible for a user for each of short blocks included in the predetermined block;

a first selection step, when a plurality of first weighted error signals , each of which indicates a signal obtained by assigning a weight, corresponding to each short block included in the predetermined block, to an error signal of the short block , are generated, to compare the plurality of first weighted error signals with one another, and to select a given quantization method from among the plurality of quantization methods based on a result of the comparison; and

a step, when the input signal of the predetermined block is quantized based on the given quantization method and then the input signal quantized is encoded, of outputting the input

signal encoded as an output signal.

24. The program according to claim 23,

wherein the weight calculation step comprises a step of calculating, a weight related to degree concerning whether or not quantization noise corresponding to an error signal of each of subblocks into which the predetermined block is divided is virtually imperceptible for the user, for each subblock included in the predetermined block, and

wherein, when a plurality of first weighted error signals ,each of which indicates a signal obtained by assigning a weight, corresponding to each subblock included in the predetermined block, to an error signal of the subblock, are generated, the first selection step comprises a step of comparing the plurality of first weighted error signals with one another, and selects a given quantization method from among the plurality of the quantization methods based on a result of the comparison.

25   The program according to claim 23, the program causing the computer to execute processing further comprising

a step of calculating electric power values of the plurality of first weighted error signals respectively,and

wherein the first selection step comprises a step of comparing the electric power values of the plurality of first weighted error signals with one another, and of selecting a given quantization method from among the plurality of the quantization methods based on a result of the comparison.

26. The program according to claim 23,

wherein the program causes the computer to execute processing further comprising

a step of instructing a unit configured to perform the quantization step so as not to perform quantization based on any quantization method other than a predetermined quantization method, when the predetermined quantization method is selected in the first selection step.

27. The program according to claim 23, the program causing the computer to execute processing further comprising
a step of generating the plurality of quantization methods based on an amount of information of encoding terms necessary for expressing the output signal to be outputted.

28. The program according to claim 24,
wherein the weight calculation step comprises:
a step of calculating linear prediction parameters by performing a linear prediction analysis of the input signal for each of the subblocks in the predetermined block; and
a step of generating, for each subblock, a weight related to degree concerning whether or not quantization noise corresponding to an error signal of the subblock is virtually imperceptible for the user, based on the linear prediction parameters thus calculated.

29 The program according to claim 24, the program causing the computer to execute processing comprising,
instead of the weight calculation step:
a step of calculating linear prediction parameters by performing a linear prediction analysis of the input signal for each of the subblocks;
a step of calculating ,based on the linear prediction parameters calculated for each of the subblocks, an average of

the linear prediction parameters for each subblock;

a step of calculating weighting linear prediction parameters corresponding to the predetermined block, based on the average of the linear prediction parameters calculated for each subblock;
and

a generation step of generating a weight related to degree concerning whether or not quantization noise corresponding to an error signal of the predetermined block is virtually imperceptible for the user, based on the weighting linear prediction parameters corresponding to the predetermined block, and

comprising, instead of the first selection step,

a step, when a plurality of second weighted error signals ,each of which indicates a signal obtained by assigning the weight generated in the generation step , to an error signal of the predetermined block, are generated,of comparing the plurality of second weighted error signals with one another, and of selecting the given quantization method from among the plurality of quantization methods based on a result of the comparison.

30. The program according to claim 24,

wherein the weight calculation step comprises:

a step of subjecting the input signal to linear transformation into a transformed signal for each of the subblock;

a step of generating, for each of the subblocks, a weight related to degree concerning whether or not quantization noise corresponding to an error signal of the subblock is virtually imperceptible for the user, based on the transformed signal of

each subblock; and

a step of performing an inverse linear transformation of each weight thus generated.

31.   The program according to claim 24, the program causing the computer to execute processing, comprising, instead of the weighting calculation step:

a step of subjecting the input signal to linear transformation into a transformed signal for each of the subblocks;

a step of calculating ,based on transformed signal values which are values of each transformed signal subjected to the linear transformation, transformation average values corresponding to the predetermined block ,each indicating an average of the transformed signal values;

a step of generating a weight related to degree concerning whether or not quantization noise corresponding to an error signal of the predetermined block is virtually imperceptible for the user, based on the transformation average values corresponding to the predetermined block; and

an inverse transformation step of performing inverse linear transformation of the generated weight, and

further comprising, instead of the first selection step:

a step, when a plurality of second weighted error signals ,each of which indicates a signal obtained by assigning the weight inversely transformed by the inverse transformer, to an error signal of the predetermined block, are generated, of comparing the plurality of second weighted error signals with one another, and of selecting a given quantization method from among the plurality of quantization methods based on a result

of the comparison.

32. The program according to claim 24,

wherein the weight calculation step comprises:

a step of calculating a signal electric power value indicating an electric power value of the input signal for each of the subblocks; and

a step of generating, for each of the subblocks, a weight related to degree concerning whether or not quantization noise corresponding to an error signal of the subblock is virtually imperceptible for the user, based on the signal electric power value corresponding to each subblock.

33. The program according to claim 24, the program causing the computer to execute processing comprising, instead of the weighting calculation step:

a step of calculating a signal electric power value indicating an electric power value of the input signal for each of the subblocks;

a step of calculating an electric power function indicating distribution of the signal electric power values corresponding to the predetermined block based on the respective signal electric power values thus calculated; and

a generation step of generating a weight related to a degree concerning whether or not the quantization noise corresponding to the error signal of the predetermined block is virtually imperceptible for the user, based on the calculated electric power function,

and processing further comprising, instead of the first selection step:

a step, when a plurality of second weighted error signals indicating signals obtained by assigning the weights, generated in the generation step, to the error signals of the predetermined bloc are generated, of comparing the plurality of second weighted error signals with one another, and of selecting the predetermined quantization method from the plurality of quantization methods based on a result of the comparison.